UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

# BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 20

Application Number: 09/642,765
Filing Date: August 22, 2000
Appellant(s): TAUGUCHI ET AL.

Michael Tobias
For Appellant

MAILED
AUG 22 2003
GROUP 1700

## EXAMINER'S ANSWER

This is in response to the appeal brief filed 4/17/03.

*(1) Real Party in Interest*

A statement identifying the real party in interest is contained in the brief.

*(2) Related Appeals and Interferences*

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

*(3) Status of Claims*

The statement of the status of the claims contained in the brief is correct.

*(4) Status of Amendments After Final*

No amendment after final has been filed.

*(5) Summary of Invention*

The summary of invention contained in the brief is correct.

*(6) Issues*

The appellant's statement of the issues in the brief is correct.

*(7) Grouping of Claims*

Appellant's brief includes a statement that certain claims do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8). The examiner agrees with the applicants' statements of separate grouping of claims for each issue, as explain in each issue.

*(8) Claims Appealed*

The copy of the appealed claims contained in the Appendix to the brief is correct.

*(9) Prior Art of Record*

| | | |
|---|---|---|
| 5,928,404 | Paruchuri et al. | 07-1999 |

| | | |
|---|---|---|
| 6,077,477 | Sakai et al. | 06-2000 |
| WO 97/09455 | Hitch et al. | 03-1997 |
| 5,540,379 | Kazem-Goudarzi et al. | 07-1996 |
| 5,352,407 | Seelig et al. | 10-1994 |

***(10) Grounds of Rejection***

The following ground(s) of rejection are applicable to the appealed claims:

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paruchuri et al. (5928404).

With respect to claims 1 and 2, Paruchuri et al. teaches a lead-free solder paste including a 96.5% tin- 3.5% silver alloy powder mixed with 3-10% elemental copper (Column 3, lines 59-65), and also a flux (see Column 3, lines 23-24). Although Paruchuri et al. does not teach using less than 3% copper as claimed, the prior art range is so close that one skilled in the art would have expected it to have the same properties. *Titanium Metals Corp. v. Banner,* 227 USPQ 773.

Claims 1-16, 18-20, and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paruchuri et al. (5928404), in view of Sakai et al. (6077477).

With respect to claims 1, 2, and 13, Paruchuri et al. teaches a lead-free solder paste including a 96.5% tin- 3.5% silver alloy powder mixed with 3-10% elemental copper (Column 3, lines 59-65, and also a flux (see Column 3, lines 23-24). Paruchuri et al. does not teach a solder paste having less than 3% copper. Sakai et al. teaches a lead-free solder alloy having 92-97% Sn, 3-6% Ag and 0.1-2% Cu (Column 2, lines 20-24). This teaching is also emphasized in embodiment 1, shown in Table 1 (Column 3), which has 94.5% Sn, 5% Ag, and 0.5% Cu. Paruchuri et al. and Sakai et al. are analogous art because they are from the same field of endeavor, which is soldering. It would have been obvious to modify the solder paste of Paruchuri et al. by including an amount of copper less than 3% because as Sakai et al. teaches a solder joint having this small amount of copper has enhanced mechanical properties (Column 2, lines 28-30).

With respect to claims 18 and 23-24, Paruchuri et al. teaches that the solder paste is printed onto a board, and electronic component is placed in the paste, and the assembly is heated to a temperature sufficient to cause the powder to melt and flow (Column 3, lines 23-29). Furthermore, Paruchuri et al. teaches that the composite solder paste may be printed and then reflowed (Column 7, lines 60-61). This may be done at any temperature sufficient to reflow the solder, including that which would melt the powders.

With respect to claims 3-7 and 14-15, Paruchuri et al. teaches that a solder is made by mixing a tin-silver alloy with "an additive powder of tin…silver…copper…or combinations thereof (Column 5, lines 8-12)". Thus, the mixing of a tin-silver alloy with a tin-silver-copper alloy or a tin-copper alloy are envisioned by the teachings of Paruchuri et al. Paruchuri et al. does not teach the specific solder composition of the claim. Sakai et al. teaches a lead-free solder

alloy having 92-97% Sn, 3-6% Ag and 0.1-2% Cu (Column 2, lines 20-24). This teaching is also emphasized in embodiment 1, shown in Table 1 (Column 3), which has 94.5% Sn, 5% Ag, and 0.5% Cu. Paruchuri et al. and Sakai et al. are analogous art because they are from the same field of endeavor, which is soldering. It would have been obvious to modify the solder paste of Paruchuri et al. by including an amount of copper less than 3% because as Sakai et al. teaches a solder joint having this small amount of copper has enhanced mechanical properties (Column 2, lines 28-30). It would have been obvious to modify the solder paste of Paruchuri et al. to the compositional teachings of Sakai et al. because as Sakai et al. teaches a solder joint having this composition has enhanced properties (Column 2, lines 25-30).

With respect to claims 8, 11, 12, 16, and 19-20, Paruchuri et al. teaches that the solder paste is printed onto a board, and electronic component is placed in the paste, and the assembly is heated to a temperature sufficient to cause the powder to melt and flow (Column 3, lines 23-29). Furthermore, Paruchuri et al. teaches that the composite solder paste may be printed and then reflowed (Column 7, lines 60-61). This may be done at any temperature sufficient to reflow the solder, including that which would melt the powders.

With respect to claims 9-10, the reflow temperature is a property of the solder used. The composition, as taught by Sakai et al., has a melting point of 237-245°C (Column 3, Table 1).

Claims 1-16, 18-20, and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Paruchuri et al. (5928404), in view of Hitch et al. (WO 97/09455).

With respect to claims 1, 2, and 13, Paruchuri et al. teaches a lead-free solder paste including a 96.5% tin- 3.5% silver alloy powder mixed with 3-10% elemental copper (Column 3,

lines 59-65), and also a flux (see Column 3, lines 23-24). Paruchuri et al. does not teach a solder paste having less than 3% copper. Hitch et al. teaches a lead-free solder alloy having 93.8-96.4% Sn, 3.1-3.5% Ag and 0.5-2.7% Cu (page 2, lines 24-25). This teaching is also emphasized in example alloys 1, 2, and 3 on pages 3-4 which teach compositions of 95.8Sn-3.5Ag-0.67Cu (described as the superior alloy), 94.0Sn-4.5Ag-1.5Cu, and 94.3An-5.0Ag-0.7Cu respectively. Paruchuri et al. and Hitch et al. are analogous art because they are from the same field of endeavor, which is soldering. It would have been obvious to modify the solder paste of Paruchuri et al. by including an amount of copper less than 3% because as Hitch et al. teaches a solder joint of this composition has superior properties.

With respect to claims 18 and 23-24, Paruchuri et al. teaches that the solder paste is printed onto a board, and electronic component is placed in the paste, and the assembly is heated to a temperature sufficient to cause the powder to melt and flow (Column 3, lines 23-29). Furthermore, Paruchuri et al. teaches that the composite solder paste may be printed and then reflowed (Column 7, lines 60-61). This may be done at any temperature sufficient to reflow the solder, including that which would melt the powders.

With respect to claims 3-7 and 14-15, Paruchuri et al. teaches that a solder is made by mixing a tin-silver alloy with "an additive powder of tin…silver…copper…or combinations thereof (Column 5, lines 8-12". Thus, the mixing of a tin-silver alloy with a tin-silver-copper alloy or a tin-copper alloy are envisioned by the teachings of Paruchuri et al. Paruchuri et al. does not teach the specific solder composition of the claim. Hitch et al. teaches a lead-free solder alloy having 93.8-96.4% Sn, 3.1-3.5% Ag and 0.5-2.7% Cu (page 2, lines 24-25). This teaching is also emphasized in example alloys 1, 2, and 3 on pages 3-4 which teach compositions of

95.8Sn-3.5Ag-0.67Cu (described as the superior alloy), 94.0Sn-4.5Ag-1.5Cu, and 94.3An-5.0Ag-0.7Cu respectively. Paruchuri et al. and Hitch et al. are analogous art because they are from the same field of endeavor, which is soldering. It would have been obvious to modify the solder paste of Paruchuri et al. to the composition of Hitch et al. because as Hitch et al. teaches a solder joint of this composition has superior properties.

With respect to claims 8, 11, 12, 16, and 19-20, Paruchuri et al. teaches that the solder paste is printed onto a board, and electronic component is placed in the paste, and the assembly is heated to a temperature sufficient to cause the powder to melt and flow (Column 3, lines 23-29). Furthermore, Paruchuri et al. teaches that the composite solder paste may be printed and then reflowed (Column 7, lines 60-61). This may be done at any temperature sufficient to reflow the solder, including that which would melt the powders.

With respect to claims 9-10, the reflow temperature is a property of the solder used. The compositions, as taught by Hitch et al., has a melting point of 213-218°C, 214-21°C, and 214-216°C respectively for alloys 1, 2, and 3 (pages 3-4).

Claims 3-12, 14-16, 18-20, and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kazem-Goudarzi et al. (5540379), in view of Seelig et al. (5352407), and further in view of Sakai et al. (6077477).

With respect to claims 3-7 and 14-15, Kazem-Goudarzi et al. teaches a solder paste made from two different tin alloy powders, which in a preferred embodiment are a Sn-Pb-Ag alloy powder and a Sn-Pb-Bi alloy powder (Columns 3-4, lines 65-7). Kazem-Goudarzi et al. goes on to teach "alloys of elements such as tin…copper…silver may also be used" (Column 4, lines 27-

29). Kazem-Goudarzi et al. does not specifically teach the Sn-Ag-Cu compositions claimed. Seelig et al. teaches removing lead and bismuth from solder alloys as lead is toxic (Column 1, lines 29-34) and generates hazardous waste, while bismuth is mined from lead ore and is not abundantly available (Column 1, lines 48-59). Seelig et al. goes on to teach that such a lead-free, bismuth-free solder would include tin, silver, and copper (Column 2). Seelig et al. does not, however, teach specifically the Sn-Ag-Cu compositions claimed. Sakai et al. teaches a lead-free solder alloy having 92-97% Sn, 3-6% Ag and 0.1-2% Cu (Column 2, lines 20-24). This teaching is also emphasized in embodiment 1, shown in Table 1 (Column 3), which has 94.5% Sn, 5% Ag, and 0.5% Cu.

Kazem-Goudarzi et al., Seelig et al., and Sakai et al. are analogous art because they are from the same field of endeavor, which is soldering. It would have been obvious to modify the dual alloy paste of Kazem-Goudarzi et al. by using alloys of tin with copper and/or silver to arrive at a final composition such as that taught by Sakai et al. because Seelig et al. teaches removing the lead and bismuth and using Sn-Ag-Cu instead, while Sakai et al. teaches that the specific Sn-Ag-Cu compositions exhibit superior properties.

With respect to claims 8, 11, 12, 16, 18-20, and 23-24, Kazem-Goudarzi et al. teaches that the dual alloy solder paste is printed onto a PCB and reflowed (Column 4, lines 34-47). Although Kazem-Goudarzi et al. does not specifically refer to reflow soldering a surface mounted device or a chip component, the processing of the paste as described is known to be used for exactly that purpose. This may be done at any temperature sufficient to reflow the solder, including that which would melt the powders, and in fact exactly that is done in the second heating step, which is a single heating step.

With respect to claims 9-10, the reflow temperature is a property of the solder used. The composition, as taught by Sakai et al., has a melting point of 237-245°C (Column 3, Table 1).

Claims 3-12, 14-16, 18-20, and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kazem-Goudarzi et al. (5540379), in view of Seelig et al. (5352407), and further in view of Hitch et al. (WO 97/09455).

With respect to claims 3-7 and 14-15, Kazem-Goudarzi et al. teaches a solder paste made from two different tin alloy powders, which in a preferred embodiment are a Sn-Pb-Ag alloy powder and a Sn-Pb-Bi alloy powder (Columns 3-4, lines 65-7). Kazem-Goudarzi et al. goes on to teach "alloys of elements such as tin…copper…silver may also be used" (Column 4, lines 27-29). Kazem-Goudarzi et al. does not specifically teach the Sn-Ag-Cu compositions claimed. Seelig et al. teaches removing lead and bismuth from solder alloys as lead is toxic (Column 1, lines 29-34) and generates hazardous waste, while bismuth is mined from lead ore and is not abundantly available (Column 1, lines 48-59). Seelig et al. goes on to teach that such a lead-free, bismuth-free solder would include tin, silver, and copper (Column 2). Seelig et al. does not, however, teach specifically the Sn-Ag-Cu compositions claimed. Hitch et al. teaches a lead-free solder alloy having 93.8-96.4% Sn, 3.1-3.5% Ag and 0.5-2.7% Cu (page 2, lines 24-25). This teaching is also emphasized in example alloys 1, 2, and 3 on pages 3-4 which teach compositions of 95.8Sn-3.5Ag-0.67Cu (described as the superior alloy), 94.0Sn-4.5Ag-1.5Cu, and 94.3An-5.0Ag-0.7Cu respectively.

Kazem-Goudarzi et al., Seelig et al., and Hitch et al. are analogous art because they are from the same field of endeavor, which is soldering. It would have been obvious to modify the

dual alloy paste of Kazem-Goudarzi et al. by using alloys of tin with copper and/or silver to arrive at a final composition such as that taught by Hitch et al. because Seelig et al. teaches removing the lead and bismuth and using Sn-Ag-Cu instead, while Hitch et al. teaches that the specific Sn-Ag-Cu compositions exhibit superior properties.

With respect to claims 8, 11, 12, 16, 18-20, and 23-24, Kazem-Goudarzi et al. teaches that the dual alloy solder paste is printed onto a PCB and reflowed (Column 4, lines 34-47). Although Kazem-Goudarzi et al. does not specifically refer to reflow soldering a surface mounted device or a chip component, the processing of the paste as described is known to be used for exactly that purpose. This may be done at any temperature sufficient to reflow the solder, including that which would melt the powders, and in fact exactly that is done in the second heating step, which is a single heating step.

With respect to claims 9-10, the reflow temperature is a property of the solder used. The compositions, as taught by Hitch et al., has a melting point of 213-218°C, 214-21°C, and 214-216°C respectively for alloys 1, 2, and 3 (pages 3-4).

***(11) Response to Argument***

Regarding the objection to claim 5 as a substantial duplicate of claim 4, as per Paper No. 19, the objection has been overcome. Also, the rejections of claims 17, 21, and 22 have been overcome and thus these claims are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Issue 1

The argument presented to this rejection concerns claim 1 and the limitation of "less than 3 mass% Cu" as being obvious over a teaching by Paruchuri et al. of a Cu content of 3-10%. The applicant does not argue the teachings regarding the Ag or Sn content, nor that the paste of Paruchuri et al. meets the requirements of being a mixture of different metal powders as claimed, but only that it does not meet the specific Cu content of the claim. The applicant has not demonstrated the criticality of the end point of the range that is "less than 3" such that it would distinguish over the cited art, particularly in light of the fact that the claims originally included the end point of 3% but were amended specifically around the cited art. The applicant has submitted the data in Table 1, but this data is not commensurate in scope and does not demonstrate any criticality to the "less than 3%" portion of the claimed range. In the absence of such a showing, the rejection stands.

Issue 2

The first argument presented to this rejection concerns the limitation of "less than 3 mass% Cu" as being obvious over a teaching by Paruchuri et al. of a Cu content of 3-10%, in view of Sakai et al.'s teachings of 0.1-2% Cu. The applicant does not argue the teachings regarding the Ag or Sn content, nor that the paste of Paruchuri et al. meets the requirements of being a mixture of different metal powders as claimed, but only that it does not meet the specific Cu content of the claim.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, it would be obvious to use the Sn alloy powder of Sakai et al. in place of or in combination with that of Paruchuri et al. as Sakai et al. teaches this alloy for the soldering of electronic components has enhanced mechanical properties, specifically thermal fatigue (Column 1, lines 65-67 and also Column 5, lines 1-3) and Paruchuri et al. was concerned with the mechanical properties of the solder, including fatigue resistance as the applicant has pointed out.

The applicant argues that Sakai et al. is silent about copper having any advantageous effect on fatigue strength but that Sakai et al. teaches that silver improves the thermal fatigue resistance characteristics. However, Sakai et al. does not need to specifically teach that copper improves the fatigue strength in order for the references to be properly combinable nor for the rejection itself to be proper. While it may be true that Sakai et al. contains teachings regarding silver (which the solder of Paruchuri et al. already contains), it is also true that Sakai et al. specifically teaches, as cited originally in the rejection, that the "small amount" of Cu improves junction strength (Column 2, lines 28-30 and again in Column 4, lines 61-63), a mechanical property. Paruchuri et al. is concerned with improving specifically the thermal fatigue, and in doing so without degrading the general mechanical strength (see Column 3, lines 1-8,Column 6, lines 39-47, and Column 7, lines 19-21 all of which demonstrate the importance of general

mechanical joint strength) and so the teaching of improved junction strength by using a specific amount of Cu would still appear relevant and thus properly combinable. The fact that the applicant has discovered another advantage to the alloy of Sakai et al. does not make the alloy patentable.

The applicant goes on to argue that there is no teaching in Sakai et al. that its solder alloy is superior or even comparable to that of Paruchuri et al.. It is not required that one reference refer to or incorporate another in order for the two to be combinable, nor is it required that Sakai et al. specifically teach it produces a better result than Paruchuri et al. in particular. It is enough that both references are drawn to solder alloys for joining electronic parts that have the same or similar alloy components and certain improved or desirable properties. The applicant goes on to suggest that since Paruchuri et al. includes an additive powder and Sakai et al. does not, the two are fundamentally different and therefore uncombinable. Sakai et al. is relied upon to modify that part of the Paruchuri et al. alloy that is the Sn alloy powder, not the elemental additive powder. Sakai et al. provides teachings of a Sn alloy powder for soldering electronic parts which has excellent properties. One of ordinary skill in the art would thus be motivated to modify the Sn alloy powder of Paruchuri et al. for soldering electronic parts in order to achieve the improved characteristics the composition of Sakai et al. provides in the finished electronic part, which same characteristics Paruchuri et al. also sought.

The applicant next argues with regards to claim 3 that Paruchuri et al. does not teach mixing a tin-silver alloy with either a tin-silver-copper alloy or a tin-copper alloy, in spite of the cited section of Paruchuri et al..(Column 5, lines 8-12). The applicant attempts to support this argument by discussing the semantics of "combinations thereof" as distinct over "alloy" of

powders. The applicant further states that there is no specific example in Paruchuri et al. using more than one alloy. The teachings of Paruchuri et al., however, are not limited to the specific examples given, and the teaching by Paruchuri et al. of "a primary powder of tin-silver alloy or tin-lead-silver alloy, and an additive powder of tin, lead, silver, nickel, copper, or bismuth, or combinations thereof" would encompass a tin-silver alloy and either a tin-silver-copper alloy or tin-copper alloy regardless of whether there are specific examples as such. The term "combinations thereof" as used by Paruchuri et al. would appear to encompass the term "alloy" as used by the applicant. The applicant argues that " 'combinations thereof" often means simply 'two or more of the enumerated items' without any connotation as to what type of combination…is intended". Thus it appears the applicant supports the fact that "combinations thereof" is broad but would encompass a more specific type of combination, i.e. an alloy. Applicant further suggests that the only lead-free solder composition disclosed by Paruchuri et al. is in column 3, lines 59-66 and that Paruchuri et al. never contemplates mixing two Sn alloy powders in a lead-free solder paste. Again, the examiner must maintain that the teaching of "a primary powder of tin-silver alloy or tin-lead-silver alloy, and an additive powder of tin, lead, silver, nickel, copper, or bismuth, or combinations thereof" would encompass a tin-silver alloy and either a tin-silver-copper alloy or tin-copper alloy regardless of whether there are specific examples as such.

The applicant proceeds to go through a lengthy discussion of "hypothetical" alloy pastes A and B, neither of which are drawn from any of the cited references or the instant application and as such will not be individually or specifically addressed.

Applicant applies the same arguments from claim 3 to claims 4-7. Applicant argues with respect to claims 13 and 15 the same arguments as made with respect to the combination of Paruchuri et al. and Sakai et al. as described above.

Issue 3

The first argument presented to this rejection concerns the limitation of "less than 3 mass% Cu" as being obvious over a teaching by Paruchuri et al. of a Cu content of 3-10%, in view of Hitch et al.'s teachings of a specific example having 0.67%Cu. The applicant does not argue the teachings regarding the Ag or Sn content, nor that the paste of Paruchuri et al. meets the requirements of being a mixture of different metal powders as claimed, but only that it does not meet the specific Cu content of the claim. Much of the arguments made against the Hitch et al. references are the same or similar in nature to those made regarding Sakai et al. such as there is no suggestion in the references specifically that the alloys are superior or comparable or that the two solder alloys function differently as one has an additive and the other does not. For the sake of brevity, only substantially different arguments will be addressed herein.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, it would be obvious to use the Sn alloy powder of Hitch et al. in place of or

in combination with that of Paruchuri et al. as Hitch et al. teaches this alloy has enhanced mechanical properties, including fatigue life (page 2, lines 18-22) and Paruchuri et al. was concerned with the mechanical properties of the solder, including fatigue resistance as applicant has pointed out. Applicant argues that Hitch et al. only discusses these properties in relative terms and that Hitch et al. never gives any reason why the copper content is within specified range. Hitch et al. does not need to quantify results nor specifically teach that the copper content range improves the fatigue strength in order for the references to be properly combinable nor for the rejection itself to be proper. Hitch et al. describes the alloy having 0.67Cu as "Best of alloys shown" in fatigue testing and further that corrosion results are "Very good" and solderability "Excellent" and this would provide sufficient motivation to one of ordinary skill in the art regardless of whether it is quantitative information or not.

Similarly to Sakai et al., Hitch et al. is relied upon only to modify the Sn alloy portion of the teachings of Paruchuri et al. and thus the fact that Hitch et al. contains no additive powder is irrelevant in relation to this specific motivation and combination.

Regarding claim 3, the applicant presents substantially the same argument as above and the same rebuttal applies. Applicant applies the same arguments from claim 3 to claims 4-7.

Applicant argues with respect to claims 13 and 15 the same arguments as made with respect to the combination of references as described above.

Regarding claims 9 and 10, the applicant presents substantially the same argument as above and the same rebuttal applies.

Issue 4

The applicant first argues that Seelig et al. does not teach a Sn-Ag-Cu alloy as an alternative to prior art solder alloys containing lead and bismuth, such as that disclosed by Kazem-Goudarzi et al., because antimony is an essential element of Seelig et al. and there is no motivation to remove it. However, first the examiner would question whether 0.2-2.0% antimony in an alloy having only 4 components would make antimony an essential element in the solder composition. This point aside for the time being, three references are used in this rejection. Seelig et al. is not relied upon to teach a final solder composition. Seelig et al. is relied upon to show that the removal of lead and bismuth is desirable in the solder alloy art. The fact that Seelig et al. includes a small percentage of antimony is remedied by the fact Sakai et al. teaches an alloy having desirably improved properties and has no antimony. Such teaching amounts to teaching that removing the antimony still results in a desirable or improved solder alloy. From a different angle, Seelig et al. does not teach any significance or importance of the antimony and Kazem-Goudarzi et al. clearly states that antimony is often present only as an impurity (Column 1, lines 30-31). The applicant attempts to rebut this teaching in Kazem-Goudarzi et al. by explaining that antimony is often alloyed with lead that is recovered from batteries. While this is an interesting and perhaps true fact, it appears irrelevant to the art and the argument. Kazem-Goudarzi et al. makes no mention of this fact and furthermore does not suggest that the lead for use in the solder alloys is desirably recovered from batteries. In fact, none of the references cited state this or suggest it, and so there is no evidence in the record to this fact or that it applies to the cited art. There is evidence in the record, however, that antimony is often present as an impurity in many

solders, which would suggest that antimony is not essential to a solder such as that taught by Kazem-Goudarzi et al. nor that taught by Seelig et al..

Applicant argues that there is no teaching in either Seelig et al. or Sakai et al. that there exist solder alloys that are capable of meeting the requirements of Kazem-Goudarzi et al. and satisfying the final compositional ranges of the claim. As Sakai et al., teaches acceptable ranges of components of the composition and the liquidus temperature would inherently vary over this compositional range, the requirement would be met in that one would be greater than another. Surely the applicant does not suggest that all solder compositions that meet the claimed compositional ranges would have the same liquidus. The applicant goes on to claim that the alloys of Sakai et al. do not have "melting points sufficiently different" from each other to permit them to be used in Kazem-Goudarzi et al. However, as the applicant states, Kazem-Goudarzi et al. does not teach how far apart the melting ranges of the two alloys must be. Indeed the claim of Kazem-Goudarzi et al. requires only that one solder have a greater liquidus temperature than the other. Thus it appears the rejection meets these limitations.

The applicant also argues that Sakai et al. teaches only single-alloy pastes, yet Kazem-Goudarzi et al. is relied upon as the primary reference and for the teaching of a dual-alloy solder paste. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the

teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the art relied upon is drawn to various solder compositions having varying improved properties specific to use in soldering electronic components while minimizing the use of any toxic or hazardous materials and waste.

Applicant applies the same arguments from claim 3 to claims 4-7.

Regarding claim 18, the applicant makes the same arguments as applied to the claims above and so the same rebuttal applies.

Regarding claims 9 and 10, the applicant appears to argue the melting point of the solder alloy of Kazem-Goudarzi. However, this argument ignores the fact that this is a 103 rejection made with a combination of references. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). In using Sn alloy powders such as those taught by Seelig et al. and Sakai et al. in a composition and method such as that taught by Kazem-Goudarzi et al., according to the combination of references in the rejection made, the melting points of such alloys would indeed meet these requirements. The applicant argues that it is pure conjecture what the melting points will be, but given that the teachings are drawn to compositions having specific ranges and meeting specific final ranges, the examiner's position is that one of ordinary skill in the art

would know the melting points of these basic Sn-Ag-Cu alloys, that they are not open to conjecture but are indeed fixed and factual properties inherent in these compositions. Although the preceding is sufficient response, the examiner would like to also point out that these claims do not even require the entirety of the composition to melt at the claimed temperature, as do other claims, but simply that reflow occurs at this temperature. Thus, it is submitted that the rejection meets these claim limitations. Lastly, the fact that the applicant has found that reflow at this temperature reduces the chances of thermal damage, and thus has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

The applicant attempts to explain the mechanisms by which the solder of Kazem-Goudarzi et al. operates, going into some detail regarding aggregates, matrices formed, and particles which are no longer existing. It is unclear to the examiner why the applicant does not simply rely upon quoting the reference directly, as the references describes exactly these mechanisms (see Column 4, lines 48-58 describing the first reflow, Column 4, line 64 to Column 5, line 9 describing the resulting product after the first reflow step, and Column 5, lines 40-46 describing the final reflow step). In not relying upon the reference, the applicant appears to have mischaracterized the second reflow step of Kazem-Goudarzi et al. The applicant characterizes this second reflow as melting ONLY the high temperature alloy and apparently not melting the low temperature alloy. It would seem intuitive that a temperature sufficient to melt a high temperature alloy would also melt a low temperature alloy. Luckily, the reference is quite clear so we need not rely upon intuition alone. Kazem-Goudarzi et al. clearly describes the second

stage of reflow (in Column 5, lines 40-46) indicating that both alloys melt once the high temperature liquidus is exceeded. More clearly and broadly, Kazem-Goudarzi et al. claims that the final heating step is to "a temperature sufficient to liquefy both the first and second solder materials" in claim 2. Thus, the art indeed teaches that the plurality of metal powders are completely melted in a single reflow step, in this case the final reflow step. The claim is written with open "comprising" language and therefore would encompass a method such as that taught by Kazem-Goudarzi et al., which would meet the limitations of the claimed method but which also teaches an additional initial reflow step.

<u>Issue 5</u>

Applicant argues with respect to the Seelig et al. references similarly as in Issue 5 and as such this argument and rebuttal will not be repeated.

Applicant also again questions the existence of alloys which meet the compositional ranges and have different melting points as per the teachings of Kazem-Goudarzi et al.. Applicant adds to this argument, however, that Hitch et al. teaches specific compositions having melting ranges of 213-218°C, 214-215°C, and 214-216°C (Examples 1-3) which the applicant identifies as "virtually identical" and therefore unsuitable for use. Let it be reiterated that Kazem-Goudarzi et al. only requires that one solder have a greater liquidus temperature than the other. Let it also be reiterated that the teachings of Hitch et al. are not limited to the specific examples described therein. The rebuttal made above with respect to Issue 4 also applies to this argument but will not be repeated.

Applicant makes substantially the same arguments as above, including a piecemeal analysis of the references and the argument that the applicant has recognized another advantage

that would flow naturally from following the suggestion of the prior art. The same rebuttal applies.

Applicant applies the same arguments from claim 3 to claims 4-7.

Regarding claims 9 and 10, the same rebuttal applies, as the arguments are the same as those made with respect to Issue 4.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

TOM DUNN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

Colleen P. Cooke
August 21, 2003

Conferees
Thomas Dunn
Patrick Ryan

MICHAEL TOBIAS
1730 K ST NW
SUITE 304
WASHINGTON, DC 20006